WHAT IS CLAIMED IS:

1. A driving-force distribution control system for a four-wheel-drive vehicle comprising:

a friction clutch through which a driving force produced by a driving power source is delivered to primary drive wheels and to secondary drive wheels at a distribution ratio based on an operating condition of the vehicle; and

a four-wheel-drive vehicle controller configured to be electronically connected to the friction clutch for automatically controlling the distribution ratio, the four-wheel-drive vehicle controller comprising:

(a) a torque threshold value setting section that sets a lower limit torque, above which noise and vibrations take place within the friction clutch when an input direction of torque inputted into the friction clutch is reversed, as a predetermined torque threshold value;

(b) an input-torque past-history condition decision section that determines whether a past-history condition that a clutch input torque has been greater than or equal to the predetermined torque threshold value is satisfied when a command torque for the friction clutch is greater than or equal to the predetermined torque threshold value during a time period from a time when the command torque begins to rise from a zero torque level to a current execution cycle of the driving-force distribution control system;

(c) a command torque condition decision section that determines whether a command torque condition that a current value of the command torque, produced at the current execution cycle, is greater than or equal to the predetermined torque threshold value is satisfied;

(d) a reversal-of-torque condition decision section that determines whether a reversal-of-torque condition that

an input direction of torque inputted into the friction clutch is reversed is satisfied;

(e) a countermeasure-of-noise command torque calculation section that calculates a countermeasure-of-noise command torque obtained by decreasingly compensating for the current value of the command torque when the past-history condition, the command torque condition, and the reversal-of-torque condition are all satisfied; and

(f) a clutch command torque control section that outputs a command signal corresponding to the countermeasure-of-noise command torque to the friction clutch, when the past-history condition, the command torque condition, and the reversal-of-torque condition are all satisfied.

2. The driving-force distribution control system as claimed in claim 1, wherein:

the countermeasure-of-noise command torque calculation section calculates the countermeasure-of-noise command torque, so that a deviation of the countermeasure-of-noise command torque from the current value of the command torque increases, as a magnitude of the current value of the command torque increases.

3. The driving-force distribution control system as claimed in claim 1, further comprising:

a road-surface friction coefficient detection section that detects a road-surface friction coefficient;

wherein the torque threshold value setting section sets the predetermined torque threshold value, so that the predetermined torque threshold value increases, as the road-surface friction coefficient increases.

4. The driving-force distribution control system as claimed in claim 3, wherein:

the torque threshold value setting section sets the predetermined torque threshold value, so that the road-surface friction coefficient and the predetermined torque threshold value are in direct proportion to each other.

5. The driving-force distribution control system as claimed in claim 1, further comprising:

a tight-corner period delivered torque calculation section that calculates a tight-corner period delivered torque suitable to prevent a tight-corner braking phenomenon when the vehicle rounds a tight corner; and

a select-low processing section that selects a lower one of the tight-corner period delivered torque and the countermeasure-of-noise command torque by a select-low process;

wherein the clutch command torque control section outputs a command signal corresponding to the lower torque obtained by the select-low process to the friction clutch.

6. The driving-force distribution control system as claimed in claim 1, wherein:

the friction clutch comprises an electronically-controlled coupling, the coupling comprising an electromagnetic solenoid, an armature, a pilot clutch, a pilot cam having a cam groove, a main cam having a cam groove, a ball sandwiched between the cam grooves, and a main clutch interleaved between input and output shafts of the friction clutch; and

wherein a friction torque, produced in the pilot clutch by an electromagnetic force with the electromagnetic solenoid energized, is transmitted to the pilot cam, and the

friction torque, transmitted into the pilot cam, is further multiplied and converted into an axial torque acting in an axial direction of the input shaft of the friction clutch via the ball placed between the cam grooves, and the axial torque multiplied forces the main cam axially against the main clutch to produce a friction torque whose magnitude is proportional to a magnitude of a solenoid driving current applied to the electromagnetic solenoid, by forcing the main cam axially against the main clutch.

7. The driving-force distribution control system as claimed in claim 1, further comprising:

a left-wheel speed sensor that detects a left wheel speed; and

a right-wheel speed sensor that detects a right wheel speed;

wherein the reversal-of-torque condition decision section determines that the reversal-of-torque condition is satisfied, when an absolute value of a wheel speed difference between the front and right wheel speeds becomes greater than or equal to a predetermined reversal-of-torque criterion.

8. The driving-force distribution control system as claimed in claim 1, further comprising:

a steer angle sensor that detects a steer angle;

wherein the reversal-of-torque condition decision section determines that the reversal-of-torque condition is satisfied, when the steer angle becomes greater than or equal to a predetermined reversal-of-torque criterion.

9. The driving-force distribution control system as claimed in claim 1, further comprising:

a wheel torque sensor that detects a secondary drive wheel torque inputted into the secondary drive wheels;

wherein the reversal-of-torque condition decision section determines that the reversal-of-torque condition is satisfied, when an amount of torque drop in the secondary drive wheel torque becomes greater than or equal to a predetermined reversal-of-torque criterion.

10. The driving-force distribution control system as claimed in claim 1, further comprising:

a wheel torque sensor that detects a secondary drive wheel torque inputted into the secondary drive wheels;

wherein the reversal-of-torque condition decision section determines that the reversal-of-torque condition is satisfied, when a time rate of decrease in the secondary drive wheel torque becomes greater than or equal to a predetermined reversal-of-torque criterion.

11. A driving-force distribution control system for a four-wheel-drive vehicle comprising:

a friction clutch through which a driving force produced by a driving power source is delivered to primary drive wheels and to secondary drive wheels at a distribution ratio based on an operating condition of the vehicle; and

a four-wheel-drive vehicle controller configured to be electronically connected to the friction clutch for automatically controlling the distribution ratio, the four-wheel-drive vehicle controller comprising:

(a) a torque threshold value setting means for setting a lower limit torque, above which noise and vibrations take place within the friction clutch when an input direction of torque inputted into the friction clutch is reversed, as a predetermined torque threshold value;

(b) an input-torque past-history condition decision means for determining whether a past-history condition that a clutch input torque has been greater than or equal to the predetermined torque threshold value is satisfied when a command torque for the friction clutch is greater than or equal to the predetermined torque threshold value during a time period from a time when the command torque begins to rise from a zero torque level to a current execution cycle of the driving-force distribution control system;

(c) a command torque condition decision means for determining whether a command torque condition that a current value of the command torque, produced at the current execution cycle, is greater than or equal to the predetermined torque threshold value is satisfied;

(d) a reversal-of-torque condition decision means for determining whether a reversal-of-torque condition that an input direction of torque inputted into the friction clutch is reversed is satisfied;

(e) a countermeasure-of-noise command torque calculation means for calculating a countermeasure-of-noise command torque obtained by decreasingly compensating for the current value of the command torque when the past-history condition, the command torque condition, and the reversal-of-torque condition are all satisfied; and

(f) a clutch command torque control means for outputting a command signal corresponding to the countermeasure-of-noise command torque to the friction clutch when the past-history condition, the command torque condition, and the reversal-of-torque condition are all satisfied.

12. The driving-force distribution control system as claimed in claim 11, further comprising:

a tight-corner period delivered torque calculation means for calculating a tight-corner period delivered torque suitable to prevent a tight-corner braking phenomenon when the vehicle rounds a tight corner; and

a select-low processing means for selecting a lower one of the tight-corner period delivered torque and the countermeasure-of-noise command torque by a select-low process;

wherein the clutch command torque control section outputs a command signal corresponding to the lower torque obtained by the select-low process to the friction clutch.

13. The driving-force distribution control system as claimed in claim 12, wherein:

the tight-corner period delivered torque is set to a torque value that is lower than the countermeasure-of-noise command torque and corresponds to a substantially disengaged state of the friction clutch.

14. A method of controlling a torque distribution ratio of a four-wheel-drive vehicle employing a friction clutch through which a driving torque produced by a driving power source is delivered to primary drive wheels and to secondary drive wheels at a desired distribution ratio based on an operating condition of the vehicle, the method comprising:

(a) setting a lower limit torque, above which noise and vibrations take place within the friction clutch when an input direction of torque inputted into the friction clutch is reversed, as a predetermined torque threshold value;

(b) determining whether a past-history condition that a clutch input torque has been greater than or equal to the predetermined torque threshold value is satisfied when a command torque for the friction clutch is greater than or

equal to the predetermined torque threshold value during a time period from a time when the command torque begins to rise from a zero torque level to a current execution cycle;

(c) determining whether a command torque condition that a current value of the command torque, produced at the current execution cycle, is greater than or equal to the predetermined torque threshold value is satisfied;

(d) determining whether a reversal-of-torque condition that an input direction of torque inputted into the friction clutch is reversed is satisfied;

(e) calculating a countermeasure-of-noise command torque obtained by decreasingly compensating for the current value of the command torque when the past-history condition, the command torque condition, and the reversal-of-torque condition are all satisfied; and

(f) outputting a command signal corresponding to the countermeasure-of-noise command torque to the friction clutch when the past-history condition, the command torque condition, and the reversal-of-torque condition are all satisfied.

15. The method as claimed in claim 14, further comprising:

calculating a tight-corner period delivered torque suitable to prevent a tight-corner braking phenomenon when the vehicle rounds a tight corner; and

selecting a lower one of the tight-corner period delivered torque and the countermeasure-of-noise command torque by a select-low process;

wherein a command signal corresponding to the lower torque obtained by the select-low process is output to the friction clutch.

16. The method as claimed in claim 15, further comprising:

detecting a left wheel speed and a right wheel speed;

calculating an absolute value of a wheel speed difference between the front and right wheel speeds; and

determining that the reversal-of-torque condition is satisfied, when the absolute value of the wheel speed difference becomes greater than or equal to a predetermined reversal-of-torque criterion.

17. The method as claimed in claim 15, further comprising:

detecting a steer angle; and

determining that the reversal-of-torque condition is satisfied, when the steer angle becomes greater than or equal to a predetermined reversal-of-torque criterion.

18. The method as claimed in claim 15, further comprising:

detecting a secondary drive wheel torque inputted into the secondary drive wheels; and

determining that the reversal-of-torque condition is satisfied, when an amount of torque drop in the secondary drive wheel torque becomes greater than or equal to a predetermined reversal-of-torque criterion.

19. The method as claimed in claim 15, further comprising:

detecting a secondary drive wheel torque inputted into the secondary drive wheels; and

determining that the reversal-of-torque condition is satisfied, when a time rate of decrease in the secondary drive wheel torque becomes greater than or equal to a predetermined reversal-of-torque criterion.

20. The method as claimed in claim 15, wherein:

the tight-corner period delivered torque is set to a torque value that is lower than the countermeasure-of-noise

command torque and corresponds to a substantially disengaged state of the friction clutch.